



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/077,633 | 02/15/2002 | Thomas G. Thundat | 920976.90172 | 5479 |

7590 06/11/2004

Daniel G. Radler, Esq.
c/o Quarles & Brady LLP
411 E. Wisconsin Avenue
Milwaukee, WI 53202

EXAMINER

MUTSCHLER, BRIAN L

| | |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

1753

DATE MAILED: 06/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/077,633

Applicant(s)

THUNDAT ET AL.

Examiner

Brian L. Mutschler

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-23 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 February 2002 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 20020603; 20031020.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: ____.

DETAILED ACTION***Drawings***

1. The drawings are objected to because Figure 1 does not contain a complete representation of the film **14**. The area encompassed by the film **14** is not delineated as in Figure 5.
2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "**40**" has been used to designate both the Fermi level (fig. 4) and a mirror (figs. 1 and 5).
3. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities:
 - a. On page 3 at line 3 of paragraph [0008], please change "Scottky" to --Schottky--.
 - b. On page 7 at line 5 (=last line of paragraph [0024]), please change "cam" to --can--.
 - c. As explained above in the objection to the drawings, reference character "40" has been used to identify both the Fermi level (see page 10 at line 3 of paragraph [0035]) and the mirror (see page 11 at line 1 of paragraph [0038]). The reference character of one of these features should be changed to a unique reference character.

Appropriate correction is required.

Claim Objections

5. Claims is objected to because of the following informalities:
 - a. Claim 1 recites the limitation "an electrode electrically connected to said film which applies a potential between said electrode and said substrate" in lines 4-5. Since the electrode itself does not apply the potential between the electrode and the substrate (i.e., the potential is applied by an external source such as a potentiostat), it appears that the claim should

Art Unit: 1753

either recite a potentiostat that applies the potential or the limitation should be changed so that the electrode does not apply the potential.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-6, 8-12, 17-21, and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Gurtner et al. ("Photoelectrophoretic Transport and Hybridization of DNA Oligonucleotides on Unpatterned Silicon Substrates", Journal of the American Chemical Society Vol. 122, No. 36 (September 13, 2000), pp. 8589-8594).

Regarding claims 1 and 17, Gurtner et al. disclose an apparatus and a method for using the apparatus, wherein molecules are suspended in an agarose film, which defines a substrate/film interface with the underlying substrate (fig. 1). a potential is applied between an electrode and the silicon substrate, which forms a depletion region (see p. 8590, "Experimental Setup" and "Assay Procedure"). A laser is directed at a location to create a localized photopotential (see p. 8590, "Assay Procedure"). To transport molecules, the position of the laser is changed to illuminate different locations (see p. 8594, "Photoelectrophoretic Transport of Beads").

Art Unit: 1753

Regarding claim 2, the film comprises agarose (fig. 1).

Regarding claims 3 and 18, the photon energy source is a laser (see p. 8590, "Experimental Setup").

Regarding claims 4 and 19, the laser produces a line of intense light to create a localized photopotential (fig. 1; p. 8590, "Assay Procedure").

Regarding claims 5 and 20, since the laser is scanned to transport the molecules, the photon energy source is not constant (see p. 8594, "Photoelectrophoretic Transport of Beads"). The laser is also attenuated by a filter wheel (see p. 8590, "Experimental Setup").

Regarding claims 6 and 21, the laser moves to scan the substrate the illumination across the surface of the interface (see p. 8594, "Photoelectrophoretic Transport of Beads").

Regarding claims 8 and 23, the potential between the electrode and the substrate is modulated (see p. 8594, "Photoelectrophoretic Transport of Beads").

Regarding claim 9, the surface of the substrate is patterned (fig. 2).

Regarding claims 10 and 11, the potential is 1.5-2 V (see p. 8590, "Assay Procedure").

Regarding claim 12, the potential is alternated to prevent deposition of the particles (see p. 8594, "Photoelectrophoretic Transport of Beads").

Since Gurtner et al. teach all of the limitations recited in the instant claims, the reference is deemed to be anticipatory.

Art Unit: 1753

8. Claims 1, 3-6, 13-15, and 17-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Kakutani et al. (U.S. Pat. No. 5,151,741).

Regarding claims 1 and 17, Kakutani et al. disclose an apparatus and a method for using the apparatus which transports and separates molecules using substrate that contains a photoelectric charge generating silicon layer **101a**, a film **103** containing suspended molecules **206a**, and an electrode **202** (fig. 2). A potential is applied across the substrate/film interface by potential source **207**, which creates a depletion region (fig. 2; col. 5, lines 56-63). A photon energy source **210** is scanned over the surface of the substrate to generate a localized photopotential (col. 6, lines 6-38).

Regarding claims 3 and 18, the photon energy source **210** is a laser (col. 6, lines 6-9).

Regarding claims 4 and 19, the laser creates a line of intense light to create a localized photopotential (fig. 2; col. 6, lines 6-38).

Regarding claims 5, 6, 20, and 21, the laser is scanned across the surface of the substrate (col. 6, lines 10-38). Since the laser is scanned, the photon energy is not constant at each location (col. 6, lines 10-38).

Regarding claims 13-15, the electrode is formed of an ITO layer **202** on a transparent insulating material layer **102** (fig. 2; col. 5, lines 29-33).

Since Kakutani et al. teach all of the limitations recited in the instant claims, the reference is deemed to be anticipatory.

Art Unit: 1753

9. Claims 1, 3, 4, 10, 11, and 13-15 are rejected under 35 U.S.C. 102(a) as being anticipated by Ozkan et al. ("Heterogeneous Integration through Electrokinetic Migration", IEEE Engineering in Medicine and Biology (November/December 2001), pp. 144-151).

Regarding claim 1, Ozkan et al. disclose an apparatus for electrophoretically manipulating molecules comprising a silicon substrate, an electrolyte fluid film in contact with the substrate, an electrode electrically connected to the film, and a photon energy source for generating a photopotential (fig. 1; see p. 145, "Electrolytic Cell").

Regarding claim 3, the photon energy source is a laser (see p. 147, 2nd col.).

Regarding claim 4, the laser produces a line of intense light (fig. 1).

Regarding claims 10 and 11, the applied potential is less than 10 V (fig. 2; see p. 150, "Optical Addressing").

Regarding claims 13-15, the electrode comprises an ITO layer formed on glass (fig. 1; see p. 145, "Electrolytic Cell").

Since Ozkan et al. teach all of the limitations recited in the instant claims the reference is deemed to be anticipatory.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 1753

11. Claims 7 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gurtner et al. ("Photoelectrophoretic Transport and Hybridization of DNA Oligonucleotides on Unpatterned Silicon Substrates", Journal of the American Chemical Society Vol. 122, No. 36 (September 13, 2000), pp. 8589-8594) in view of Hafeman et al. (U.S. Pat. No. 5,500,188).

Gurtner et al. disclose an apparatus and method having the limitations recited in claims 1-6, 8-12, 17-21, and 23 of the instant invention, as explained above in section 7.

Gurtner et al. further disclose that the potential is a constant potential (see p. 8590, "Assay Procedure").

The apparatus and method of Gurtner et al. differs from the instant invention because Gurtner et al. do not teach that the potential is applied using a potentiostat, as recited in claims 7 and 22.

Hafeman et al. disclose a photoelectric device using an applied potential, wherein the potential is applied using a potentiostat, which provides a constant potential (col.. 19, lines 15-50).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a potentiostat to provide the constant potential in the apparatus and method of Gurtner et al. as taught by Hafeman et al. because a potentiostat provides a constant potential by varying the current.

12. Claims 13-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gurtner et al. ("Photoelectrophoretic Transport and Hybridization of DNA

Art Unit: 1753

Oligonucleotides on Unpatterned Silicon Substrates", Journal of the American Chemical Society Vol. 122, No. 36 (September 13, 2000), pp. 8589-8594) in view of Ozkan et al. ("Heterogeneous Integration through Electrokinetic Migration", IEEE Engineering in Medicine and Biology (November/December 2001), pp. 144-151).

Gurtner et al. disclose an apparatus and method having the limitations recited in claims 1-6, 8-12, 17-21, and 23 of the instant invention, as explained above in section 7.

The apparatus of Gurtner et al. differs from the instant invention because Gurtner et al. do not disclose the following:

- a. The electrode is optically transmissive, as recited in claim 13.
- b. The electrode is indium tin oxide, as recited in claim 14.
- c. The electrode is formed from a transparent insulating material having at least one surface coated by a film of a conductive material, as recited in claim 15.

Ozkan et al. disclose a similar apparatus for photoelectrophoretically manipulating molecules that comprises an electrode made of ITO covered glass (see p. 145, "Electrolytic Cell"). The electrode covers and seals the electrolyte fluid film (fig. 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the electrode of Gurtner et al. to use an ITO-covered glass electrode as taught by Ozkan et al. because the ITO-covered glass electrode seals the apparatus, which would prevent evaporation of the sample and protect against atmospheric contamination.

Art Unit: 1753

13. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gurtner et al. ("Photoelectrophoretic Transport and Hybridization of DNA Oligonucleotides on Unpatterned Silicon Substrates", Journal of the American Chemical Society Vol. 122, No. 36 (September 13, 2000), pp. 8589-8594) in view of Ozkan et al. ("Heterogeneous Integration through Electrokinetic Migration", IEEE Engineering in Medicine and Biology (November/December 2001), pp. 144-151), as applied above to claims 13-15, and further in view of Jiang et al. (U.S. Pat. No. 6,203,985).

Gurtner et al. and Ozkan et al. describe an apparatus having the limitations recited in claims 13-15 of the instant invention, as explained above in section 12.

The apparatus described by Gurtner et al. and Ozkan et al. differs from the instant invention because they do not disclose that the conductive material is either gold or platinum, as recited in claim 16.

Jiang et al. disclose a bio-molecule analyzer using photosensitive materials and teach that transparent, conductive electrode materials may comprise ITO or thin metal layers of gold or platinum (col. 3, lines 6-10; col. 4, lines 1-4).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the ITO-covered glass electrode described by Gurtner et al. and Ozkan et al. to substitute a thin gold or platinum layer for the ITO layer because Jiang et al. teach that thin gold and platinum layers are equivalent to ITO as transparent electrode materials, and the substitution of a known material suitable for the intended use is considered an obvious modification (see MPEP 2144.07).

Art Unit: 1753

14. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ozkan et al. ("Heterogeneous Integration through Electrokinetic Migration", IEEE Engineering in Medicine and Biology (November/December 2001), pp. 144-151) in view of Jiang et al. (U.S. Pat. No. 6,203,985).

Ozkan et al. teach an apparatus having the limitations recited in claims 1, 3, 4, 10, 11, and 13-15 of the instant invention, as explained above in section 9.

The apparatus of Ozkan et al. differs from the instant invention because Ozkan et al. do not disclose that the conductive material is either gold or platinum, as recited in claim 16.

Jiang et al. disclose a bio-molecule analyzer using photosensitive materials and teach that transparent, conductive electrode materials may comprise ITO or thin metal layers of gold or platinum (col. 3, lines 6-10; col. 4, lines 1-4).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the ITO-covered glass electrode of Ozkan et al. to substitute a thin gold or platinum layer for the ITO layer because Jiang et al. teach that thin gold and platinum layers are equivalent to ITO as transparent electrode materials, and the substitution of a known material suitable for the intended use is considered an obvious modification (see MPEP 2144.07).

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Art Unit: 1753

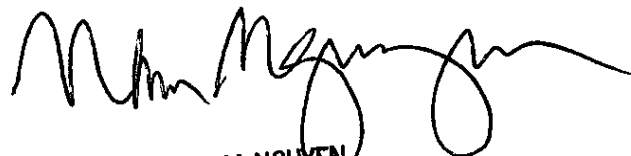
U.S. Pat. No. 6,730,208 (Bruehl), U.S. Pat. No. 6,706,473 (Edman et al.), and U.S. Pat. No. 5,985,568 (Krihak et al.) each disclose an apparatus for the photoelectric manipulation of molecules in solution.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brian L. Mutschler whose telephone number is (571) 272-1341. The examiner can normally be reached on Monday-Friday from 7:30am to 4:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

BLM
June 4, 2004



NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700